Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

RIPARIAN FOREST BUFFER

CODE 391

(ac)

DEFINITION

An area predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Reduce excess amounts of sediment, organic material, nutrients and pesticides in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow
- Restore riparian plant communities
- Create or improve riparian habitat and provide a source of detritus and large woody debris
- Reduce pesticide drift entering the water body
- Create shade to lower or maintain water temperatures to improve habitat for aquatic organisms
- Increase carbon storage in plant biomass and soils

CONDITIONS WHERE PRACTICE APPLIES

Riparian forest buffers are applied on areas adjacent to permanent or intermittent streams, lakes, ponds, and wetlands. They are not applied to stabilize stream banks or shorelines.

CRITERIA

General Criteria Applicable to All Purposes

The riparian forest buffer shall be positioned appropriately and designed to achieve sufficient width, length, vertical structure/density and connectivity to accomplish the intended purpose(s).

Dominant vegetation will consist of existing, naturally regenerated, or seeded or planted trees and shrubs suited to the soil and hydrology of the site and the intended purpose(s). Refer to Table 1 for a list of suitable woody species for riparian forest buffers.

The vegetation will extend a minimum width to achieve the purpose(s) intended. Measurement shall begin at and be perpendicular to the normal water line, bank-full elevation, or the top of the bank as determined locally.

Overland flow through the riparian area will be maintained as sheet flow.

Excessive sheet-rill and concentrated-flow erosion will be controlled in the areas immediately adjacent and up- gradient of the buffer site.

Use tree and shrub species that are native and non-invasive. Substitution with improved and locally accepted cultivars or purpose-specific species is allowed for plantings and seeding, only viable, high-quality and adapted plant materials will be used.

Favor tree and shrub species that have multiple values such as those suited for timber, nuts, fruit, browse, nesting, cover, and aesthetics.

Periodic removal of some forest products such as high value trees, medicinal herbs, nuts, and fruits is permitted provided the intended purpose is not compromised by the loss of vegetation or harvesting disturbance.

Necessary site preparation and planting shall be done at a time and in a manner to insure survival and growth of selected species for achieving the intended purpose(s). Use the Standard Tree/Shrub Site Preparation, Code 490; for guidance. Livestock shall be controlled or excluded as necessary to achieve the intended purpose. Refer to the NRCS Conservation Practice Standards: Prescribed Grazing, Code 528; and/or Use Exclusion, Code 472; as applicable.

Harmful plant and animal pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose. If pesticides are used, refer to the Standard Pest Management, Code 595.

For buffer establishment criteria refer to NRCS Conservation Practice Standard Tree/Shrub Establishment, Code 612, for additional information on the spacing, density, age, size, handling, storage and quality of planting stock.

Additional Criteria to Reduce Excess Amounts of Sediment, Organic Material, Nutrients and Pesticides in Surface Runoff and Reduce Excess Nutrients and Other Chemicals in Shallow Ground Water Flow

The minimum width shall be 35 feet measured horizontally on a line perpendicular to the water body beginning at the normal water line, bank-full elevation, or the top of the bank as determined locally.

For slopes equal to or greater than 10%; the minimum width is 50 feet and for each 1% increase in slope, add 2 feet to the minimum width.

The width will be extended in high nutrient, sediment and animal waste application areas where the contributing area is not adequately treated or where an additional level of protection is needed.

When excessive sheet-rill and concentrated flow erosion from the area immediately adjacent and upslope of the proposed buffer site is greater than 10 tons/acre/year; use NRCS Conservation Practice Standards: Filter Strip, Code 393, Field Border, Code 386, Critical Area Planting, Code 342, Grassed Waterway, Code 412 or another suitable practice to lower the amount of upslope runoff and soil erosion.

When greater than 50 percent of the runoff from the buffer site is or will remain concentrated in gullies or other channelized flow mechanisms use any suitable devise such as level spreaders, grading and shaping, vegetative barriers upslope from the riparian buffer, vegetative barriers within the riparian buffer, contour furrows, contour buffers or other suitable practices to disperse the concentrated flow. Also, use any of the above practices where combined sheet, rill and wind erosion from areas contributing sediment to the buffered area exceeds 3 tons/acre/year and the area contributing that sediment is greater than or equal to 60 times the area of the riparian buffer (≥ 60:1 upland to riparian buffer ratio).

Existing, functional subsurface drains through the riparian area will pass pollutants directly to the outlet. To filter such pollutants, drains can be plugged, removed or replaced with perforated pipe and end plugs to allow passage and filtration of drain water through the riparian forest root zone. Caution is advised that saturated conditions in the riparian and adjacent areas may limit existing land use and management.

Additional Criteria for Increasing Carbon Storage in Biomass and Soils

Maximize width and length of the riparian forest buffer to take full advantage of carbon sequestration capability.

Select plants that have higher rates of carbon sequestration in soils and plant biomass and are adapted to the site to assure strong health and vigor. Plant at the appropriate stocking rate for the site.

Use plant species that accumulate biomass quickly since they also sequester carbon faster. The rate of carbon sequestration is enhanced as riparian plants mature and soil organic matter increases. Trees that have the potential to store a significant amount of carbon are: Eastern cottonwood, hybrid poplar, black willow and other large willows, green ash, silver maple, American basswood, aspen and red and white pines; in general, hardwood species provide more carbon sequestration capability than conifers.

Additional Criteria to Create or Improve Riparian Habitat and Provide a Source of Detritus and Large Woody Debris.

The width will be extended to meet the minimum habitat requirements of the wildlife or aquatic species of concern.

SPECIES	HABIT	WSHED	AREA SENS.	AT RISK	MIN. BUFFER WIDTH
GRASSLAND BIRDS					
Sprague's Pipit	G	NW-SW	M	E	660' 1/
Clay-colored Sparrow	G	ALL			660' 1/
Grasshopper Sparrow	G	ALL	M		660' 1/
Baird's Sparrow	G	NW	M	E	660' 1/
Sedge Wren	G	ALL	L		660' 1/
Vesper Sparrow	G	ALL	L		200' 5/
Dickcissel	G	ALL	L		200' 5/
Pheasant	G	SW-SE	L		200' 5/
FOREST BIRDS					
Wood Duck	RF	ALL			270' 2/
Full Riparian Bird Community					250-660 3/ ave. 400'
Bird Habitat					300'-500' 8/
FISH					
Trout		SE MN			100' 4/
Shading, and large woody debris					100-200' 3/
HERPS					
					100'-450' 6/
MAMMALS					
Small		ALL			250' 3/
Large		ALL			330' 3/ 165' 7/

1. Grassland Species of Moderate area sensitivity; min width of 220 yds. to minimize edge: interior ratio. (Sample and Mossman 1997).
2. Wood Duck – Nest cavities w/in 270' of water. Brood water w/in 2640'. (FWS HSI)
3. Jones et al. 1988.
4. Raleigh 1982.
5. Daraveau et al 1995.
6. Rudolph and Dickson 1990, Buhlman 1998.
7. Dickson 1989.
8. Hodges and Krementz 1996; Mitchell 1996; Triquet et al 1990; Speckman and Hughes 1995.

Establish plant communities that address the target aquatic and terrestrial wildlife and pollinator needs and have multiple values such as habitat, nutrient uptake and shading. The establishment of diverse native woody and herbaceous species will enhance wildlife and pollinator values.

To provide coarse woody debris, avoid disturbing existing large downed logs and stumps. If a snag must be dropped, leave it where it falls whenever possible. To create coarse woody debris cut 2-5 bark-on logs greater than 12 inches in diameter per acre. Preferably select hollow butt sections of at least 6 feet in length or other defective logs at least 6 feet in length. Cut sound logs only if there is not enough defective material available.

For shading streams and rivers, the buffer canopy at maturity shall be established to achieve at least 50 percent crown cover with average canopy heights equal to or greater than the width of the water body or 30 feet for larger water bodies. See Figure 1.

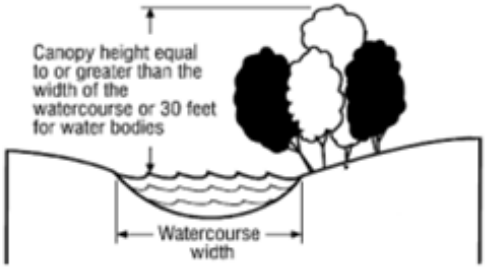

Figure 1: Canopy height for water temperature control.

CONSIDERATIONS

When planning consider the interaction of the unique soils, hydrology, and vegetation, riparian forest buffers influence on water quality as contaminants are taken up into plant tissues, adsorbed onto soil particles, or modified by soil organisms.

Use plant protection methods as appropriate including bud capping, plastic protectors, fencing and spray-on chemical inhibitors.

The severity of bank erosion and its influence on existing or potential riparian trees and shrubs should be assessed. Watershed-level treatment or bank stability activities may be needed before establishing a riparian forest buffer.

Native, non-invasive plants are preferable over non-native, introduced or invasive plants. Improved stock should be used if desired such as using disease resistant white pine in areas of high white pine blister rust areas.

Complex ownership patterns of riparian areas may require group planning for proper buffer design, function and management.

Tree and shrub species, which may be alternate hosts to undesirable pests, should be avoided. Species diversity should be considered to avoid loss of function due to species-specific pests.

Allelopathic impacts of plants should be considered. Walnut, hickory, sugar maple, hackberry, cottonwood, black locust, black cherry, red oak, and American elm are known to have allelopathic effects on nearby plants including other woody species.

Using seed and/or seedlings collected or propagated from multiple sources can increase genetic diversity. Consider selecting species with tolerance to herbicide leakage from adjoining fields.

The location layout and density of the buffer should complement natural features, and mimic natural riparian forests.

When considering a tree planting within the Prairie Region of Minnesota, it is recommended to review the Maps 1 & 2 to protect historic habitat areas and encourage ecologically appropriate plantings for the proposed site. The considerations are applicable to the Prairie Parkland and Tallgrass Aspen Provinces as defined in the Ecological Classification System (ECS).

For sites where continued function of drain tile is desired, woody root penetration may eventually plug the underground structure. In these cases, a setback of woody vegetation and planting of herbaceous cover is recommend over the drain tile. Another option would be to use rigid, non-perforated pipe to minimize woody root penetration.

Maximize widths, and lengths along with the joining of existing and new buffers increases the continuity of cover and will further moderate water temperatures. A mix of species with growth forms that are tall and wide-crowned or drooping will increase moderation effects. For water courses, buffers established on both sides will enhance multiple values for land and water wildlife species.

Is the purposed tree planting alongside a public or private ditch? An important question towards the longevity or risk of destruction of the purposed planting. Minnesota drainage law allows for maintenance of public ditches that could put the purposed planting at risk. When alongside a public drainage ditch review the Filter Strip 393 or Conservation Cover 327 standard for planting options.

As the riparian forest buffer approaches 40 years of age, it will begin to produce large stable debris. Wherever possible, this stable debris should be conserved.

In areas of high canopy density and low vegetative understory growth within riparian zones, refer to the Standard Forest Stand Improvement, 666, for management considerations.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

The riparian forest buffer will be inspected periodically and protected from adverse impacts such as excessive vehicular and pedestrian traffic, pest infestations, concentrated flows, pesticides, livestock or wildlife damage and fire.

Replacement of dead trees or shrubs and control of undesirable vegetative competition will be continued until the buffer is, or will progress to, a fully functional condition.

Any manipulation of species composition, stand structure and stocking by cutting or killing selected trees and understory vegetation shall sustain the intended purpose(s). Refer to the standard Forest Stand Improvement, 666.

Control or exclusion of livestock and harmful wildlife shall continue. Refer to the standards Prescribed Grazing, 528, and/or Access Control, 472, as applicable.

Fertilizers, pesticides and other chemicals used to maintain buffer function shall not impact water quality.

Refer to the NRCS Conservation Practice Standards Prescribed Grazing, Code 528, and/or Use Exclusion, Code, 472, as applicable. Additional operation and maintenance requirements shall be developed on a site-specific basis to assure performance of the practice as intended.

REFERENCES

Bentrup, Gary 2008. Conservation buffers: design guidelines for buffers. corridors. And greenways. Gen. Tech. Rep. SRS-109. Asheville, NC: Department of Agriculture, Forest Service, Southern Research Station.

Minnesota Forest Resources Council. *Sustaining Minnesota Forest Resources: Voluntary Site-Level Forest Management Guidelines for Landowners, Logger and Resource Managers*. 2005. Minnesota Forest Resources Council, St. Paul, MN.

Minnesota Department of Natural Resources: Ecological Classification System (ECS) http://www.dnr.state.mn.us/ecs/index.html

Recommendations for Tree and Forest Establishment and Management in Minnesota's Prairie region: prepared by; USDA Natural Resources Conservation Service, Minnesota State Technical Committee, Forestry Subcommittee: May 2013.

Understanding the Science Behind Riparian Forest Buffers: Effects on Water Quality: by Julia C. Klapproth and James E. Johnson; Virginia cooperative Extension Publication 420-151 20